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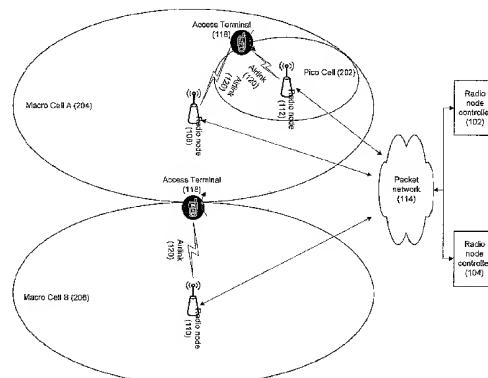
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(54) Title: RADIO NETWORK COMMUNICATION



(57) Abstract: Techniques for enabling a radio access network to cause an access terminal in communication with the radio access network to send an update including information about a location of the access terminal.

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RADIO NETWORK COMMUNICATION

TECHNICAL FIELD

This description relates to radio network communication.

BACKGROUND

5 High Data Rate (HDR) is an emerging mobile wireless access technology that enables personal broadband Internet services to be accessed anywhere, anytime (see P. Bender, et al., "CDMA/HDR: A Bandwidth-Efficient High-Speed Wireless Data Service for Nomadic Users", IEEE Communications Magazine, July 2000, and 3GPP2, "Draft Baseline Text for 1xEV-DO," August 21, 2000). Developed by Qualcomm,

10 HDR is an air interface optimized for Internet Protocol (IP) packet data services that can deliver a shared forward link transmission rate of up to 2.46 Mbit/s per sector using only (1X) 1.25 MHz of spectrum. Compatible with CDMA2000 radio access (TIA/EIA/IS-2001, "Interoperability Specification (IOS) for CDMA2000 Network Access Interfaces," May 2000) and wireless IP network interfaces (TIA/EIA/TSB-115,

15 "Wireless IP Architecture Based on IETF Protocols," June 6, 2000, and TIA/EIA/IS-835, "Wireless IP Network Standard," 3rd Generation Partnership Project 2 (3GPP2), Version 1.0, July 14, 2000), HDR networks can be built entirely on IP technologies, all the way from the mobile Access Terminal (AT) to the global Internet, thus taking advantage of the scalability, redundancy and low-cost of IP networks.

20 An EVolution of the current 1xRTT standard for high-speed data-only (DO) services, also known as the 1xEV-DO protocol has been standardized by the Telecommunication Industry Association (TIA) as TIA/EIA/IS-856, "CDMA2000 High Rate Packet Data Air Interface Specification", 3GPP2 C.S0024-0, Version 4.0, October 25, 2002, which is incorporated herein by reference. Revision A to this specification

25 has been published as TIA/EIA/IS-856, "CDMA2000 High Rate Packet Data Air Interface Specification", 3GPP2 C.S0024-A, Version 2.0, June 2005. Revision A is also incorporated herein by reference.

FIG. 1 shows a 1xEV-DO radio access network 100 with radio node controllers 102 and 104 connected to radio nodes 108, 110, and 112 over a packet network 114.

30 The packet network 114 can be implemented as an IP-based network that supports many-to-many connectivity between the radio nodes and the radio node controllers.

The packet network 114 is connected to the Internet 116 via a packet data serving node 106. Other radio nodes, radio node controllers, and packet networks (not shown in FIG. 1) can be included in the radio access network 100. The packet network 114 may be several distinct networks connecting individual radio node controllers to their 5 associated radio nodes, or it may be a single network as shown in FIG. 1, or a combination.

Typically, each radio node controller controls 25-100 radio nodes and each radio node supports 1-4 carriers each of 1.25 MHz of bandwidth. A carrier is a band of radio frequencies used to establish airlinks with access terminals. The geographic area of the 10 radio access network that is served by any given radio node is referred to as a cell. Each cell can be divided into multiple sectors (typically 3 or 6) by using multiple sectorized antennas (the term "sector" is used both conventionally and in this document, however, even when there is only one sector per cell).

Access terminals 118 communicate with the network 100 over airlinks 120. 15 Each access terminal may be a cellular phone, a laptop computer, a Personal Digital Assistant (PDA), a dual-mode voice/data handset, or another device, with built-in 1xEV-DO Rev-0 or Rev-A support. The airlink 120 between the network 100 and an access terminal 118 includes a control channel over which a serving radio node controller (i.e., the radio node controller on which a 1xEV-DO session of the access 20 terminal 118) transmits messages and parameters that the access terminal 118 may need for access and paging operations. The messages and parameters (collectively referred to in this description as "control channel messages") convey system parameters, access parameters, neighbor lists, paging messages, and channel assignment information to the access terminal 118.

FIG. 2 shows a network coverage area corresponding to the 1xEV-DO radio 25 access network 100. In this example, the radio nodes serve coverage areas of different sizes. The large coverage areas served by radio nodes 108 and 110 are referred to as macro cells, while the smaller coverage areas served by radio node 112 is referred to as a pico cell. A macro cell covers a very large geographic area; for example, the 30 metropolitan area of a city. A pico cell generally has a much smaller coverage area; for example, a single office building. The coverage area of a pico cell may partially or completely overlap the coverage area of a macro cell. The pico cell within the coverage area of the macro cell may operate on the same or different carrier frequency.

An access terminal 118 in the pico cell coverage area may access the network either through the macro cell radio node 108 or the pico cell radio node 112. Accessing the network through the pico cell radio node 112 conserves the network resources of the macro cell and vice versa.

5 There are a number of different techniques that may be implemented by the 1xEV-DO radio access network 100 to determine when a handoff between the radio nodes of overlapping pico and macro cells is to take place. One example technique involves installing, in the coverage area of the macro cell radio node, a pilot beacon that transmits a pilot signal on the same carrier frequency as that of the macro cell radio
10 node 108. A handoff can be triggered by the network upon detection of a carrier frequency change. However, these pilot beacons do not provide any actual carrier service to an access terminal and are therefore very limited in application. Additionally installation of each pilot beacon can be very expensive. Another example technique involves configuring an access terminal to constantly assume the presence of a pico cell
15 and attempt to connect to it. However, such constant activity is very draining on the limited access terminal resources, including the access terminal's battery.. Furthermore, this technique does not enable the network to determine instances in which it may be more beneficial to serve the access terminal via the macro cell radio node, although weaker pico cell signals may be available.

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SUMMARY

In general, in one aspect, a radio access network causes an access terminal in communication with the radio access network to send an update including information about a location of the access terminal.

Implementations may include one or more of the following features. The radio
25 access network causes the access terminal to send the update by broadcasting trigger information. The trigger information comprises a trigger that is specific to a cell of the radio access network. The radio access network causes the access terminal to send the update by unicasting query information. The query information comprises a query that is specific to a cell of the radio access network. The query information comprises a
30 query that is specific to a carrier frequency on which a radio node of the radio access network or a different radio access network operates. The information comprises information about one or more radio nodes each operating on a carrier frequency on

which the access terminal operates. The information comprises information about one or more radio nodes, at least one of which operates on a carrier frequency other than a carrier frequency on which the access terminal operates. The information comprises a sector identifier and a pilot strength associated with a sector of a macro cell. The 5 information comprises a sector identifier and a pilot strength associated with a sector of a pico cell. The radio access network uses the information sent by the access terminal to determine whether a handoff between cells of the radio access network is to be performed.

In general, in one aspect, an access terminal performs a comparison of a 10 recently-received cell-specific identifier with a previously-received cell-specific identifier; and takes action as a result of the comparison.

Implementations may include one or more of the following features. Each of the recently-received cell-specific identifier and the previously-received cell-specific identifier comprises a cell-specific route update trigger code. Taking action comprises 15 sending a message to a radio access network. The message comprises a pilot strength of at least one sector of the radio access network that is visible to the access terminal. Taking action comprises replacing the previously-received cell-specific identifier with the recently-received cell-specific identifier.

In general, in one aspect, when an access terminal is communicating with a first 20 cell of a network and is within a service area of both the first cell of the network and a second cell of the network, the network determines when to initiate a handoff of the access terminal from the first cell to the second cell.

Implementations may include one or more of the following features. The first cell comprises a macro cell and the second cell comprises a pico cell. The first cell 25 comprises a pico cell and the second cell comprises a macro cell. The network initiates the handoff of the access terminal from the first cell to the second cell. The network maintains a communication channel of the access terminal. The network sends a TrafficChannelAssignment message. The network closes a communication channel of the access terminal. The network sends a Unicast Redirect message. The network uses 30 information about the location of the access terminal. The information comprises a sector identifier of the first cell. The information comprises a sector identifier of the second cell. The information comprises a pilot strength associated with a sector of the first cell. The information comprises a pilot strength associated with a sector of the

second cell. The network compares the pilot strength of the first cell with the pilot strength of the second cell. The first cell and the second cell both operate on a common carrier frequency. The first cell operates on a carrier frequency and the second cell operates on a different carrier frequency

5 Advantages that can be seen in particular implementations of the invention include one or more of the following. When a macro and pico cell are controlled by the same radio network controller, the access terminal can be redirected from one to the other without experiencing an interruption in service. Allowing an access terminal to use the local resources of a pico cell when possible conserves the resources of the
10 macro cell. The access terminal is also able to conserve its resources and battery power. Additionally, by implementing the techniques in the form of software that is easy to update as new cells are added to the radio access network and additional carrier frequencies are supported by the radio access network, the network operator does not have to install expensive hardware, such as pilot beacons, in the network in order to
15 determine when handoffs between macro and pico cells are to be performed.

The details of one or more embodiments of the invention are set forth in the accompanying drawings and the description below. Other features, objects, and advantages of the invention will be apparent from the description and drawings, and from the claims.

20

DESCRIPTION OF DRAWINGS

FIGS. 1-2 each show a radio access network.

FIG. 3 shows a flowchart of a macro-pico handoff determination process.

DETAILED DESCRIPTION

In some implementations, the 1xEV-DO network 100 of FIG. 1 supports a
25 triggering mechanism that enables the network to cause an access terminal, in communication with the network, to send an update with information about the access terminal's location.

In the examples to follow, this triggering mechanism is used to facilitate handoffs between macro and pico cells within the coverage area of the network, where
30 the macro cell radio nodes operate on carrier frequency C1 and the pico cell radio nodes operate on carrier frequency C2. In some cases, the macro cell and the pico cell

are homed to the same radio node controller. In those cases in which the macro cell and the pico cell are homed to different radio node controllers, the network 100 of FIG. 1 may be implemented with a multi-homing architecture (e.g., as described in U.S. Application Serial Number 11/305,286, (attorney docket 12144-029001) titled “Radio Network Control,”) or a clustering architecture.

In other examples, the triggering mechanism is used for a variety of other applications, such as hard handoffs and multi-carrier traffic allocations. The triggering mechanism can also be used in networks that implement radio frequency dragging prevention techniques, such as those described in U.S. Application Serial Number 10 11/303,773, (attorney docket 12144-028001) titled “Radio Frequency Dragging Prevention.”

Referring to FIGS. 1-3, in some examples, each radio node controller of the 1xEV-DO network 100 of FIG. 1 has (or has access to) information about all of the operational pico cell(s) in the network 100. The information includes each pico cell's carrier frequency, PN Offset, and the macro cell(s) with which the pico cell's coverage area overlaps. The radio node of each macro cell with which a pico cell's coverage area overlaps is configured to periodically broadcast a cell-specific Route Update Trigger Code (“RUTriggerCode”) in overhead messages transmitted on the control channels of the macro cell radio node (302).

Each idle access terminal 118 periodically monitors a control channel of its serving radio node for overhead messages. Upon receipt (304) of an overhead message containing the cell-specific RUTriggerCode, the access terminal 118 compares (306) the recently-received RUTriggerCode with a RUTriggerCode stored in its memory. The RUTriggerCode stored in memory corresponds to the macro cell radio node that last served the access terminal. If the comparison yields a match, no action is taken (308). A non-match serves as an indicator that the idle access terminal has entered the coverage area of a new macro cell, and triggers the idle access terminal to send (310) a Route Update message back to the network by way of the macro cell radio node 108. The Route Update message typically identifies, to the radio node controller 102, the sectors that are visible to the idle access terminal, and for each visible sector, its associated pilot strength. The visible sectors generally include sectors of radio nodes that are operating on the same carrier frequency C1 as that of the idle access terminal. The sector identification and the relative pilot strengths enable the radio access network

to keep track of the access terminal's approximate location within the footprint of the network. For example, if the idle access terminal 118 moves from the coverage area of macro cell B 206 into the coverage area of macro cell A 204, where the radio nodes 108, 110 of both macro cells operate on the same carrier frequency C1, the idle access 5 terminal will report, as visible, the sectors of the macro cell radio node 108 in its Route Update message.

The radio node controller examines each Route Update message it receives to determine (312) whether the idle access terminal is in the coverage area of a macro cell with which a pico cell's coverage area overlaps. To do so, the serving radio node 10 controller compares the sector identification information provided in the Route Update message with the information it has about the operational pico cell(s) within the network. If the determination yields a negative result (i.e., no pico cells within the coverage area of the macro cell 108), no action is taken (314). If the determination yields a positive result (i.e., there are one or more pico cells within the coverage area of 15 the macro cell 108), the radio node controller sends (316) a specific query (referred to in this description as a Modified Route Update Request) to the access terminal. The query can be made on the access terminal's paging cycle to avoid excessive use of network resources. This query typically relates to those specific pico cells that are within the coverage area of the macro cell, including those pico cells having radio 20 nodes that are operating on a different carrier frequency C2 than that of the macro cell radio node.

Upon receipt of the Modified Route Update Request, the idle access terminal will return (318) a Route Update message. In this Route Update message, the idle access terminal reports not only the sectors of radio nodes that are operating on the 25 same carrier frequency C1 as that of the idle access terminal, but also the radio nodes that are operating on a different carrier frequency C2. In this manner, the network is made aware of the signal strengths of the sectors of pico cell radio nodes operating on a different carrier frequency C2 that are visible to the access terminal.

In instances in which the idle access terminal is at or near the boundary of a 30 pico cell coverage area, the Route Update message will likely identify, as visible, one or more sectors associated with the pico cell radio node and one or more sectors associated with the macro cell radio node. The radio node controller uses the relative reported signal strengths to determine whether a macro-to-pico handoff is to be

performed (320). In some implementations, the radio node controller examines the reported pilot strengths of each pico cell radio node to determine whether any one of the reported pilot strengths exceeds a configurable threshold for a configurable number of times. Generally, the network operator sets the configurable values such that macro-
5 to-pico handoffs are not triggered when the macro cell coverage is sufficiently strong. By continuously evaluating which radio node would most efficiently serve the idle access terminal, handoffs can be reduced or minimized to those instances in which a macro-to-pico handoff would provide for efficient network resource utilization.

In some implementations, once a determination is made to trigger a macro-to-pico handoff, the radio node controller sends a Unicast Redirect message to the access terminal. Upon receipt of the message, the idle access terminal processes the Unicast Redirect message to seamlessly transition from the carrier on which it operates to the carrier frequency specified in the Unicast Redirect message. In this case, the idle access terminal operating on the carrier frequency C1 will operate on the carrier
10 frequency C2 after the Unicast Redirect message is processed. The user disruption associated with the “switch carrier” process typically averages about 100-500 ms long and is not typically noticeable by the access terminal user, especially when the access terminal is idle.
15

In the case of an active access terminal in the coverage area of a macro cell 108,
20 the active access terminal can be configured to send a Route Update message to the network when the pilot strength associated with the macro cell radio node 108 exceeds the Pilot_Add threshold. The Route Update message identifies, to the radio node controller 102, the sectors operating on carrier frequency C1 that are visible to the active access terminal, and for each visible sector, its associated pilot strength (310).

The radio node controller examines each Route Update message it receives to determine whether the active access terminal is in the coverage area of a macro cell with which a pico cell’s coverage area overlaps in the same manner described above with reference to the idle access terminal example (314). If the determination is made
25 that there are one or more pico cells within the coverage area of the macro cell, the radio node controller sends a Modified Route Update Request to the active access terminal (316), which returns the pilot strengths of the visible sectors of the one or
30 more pico cells operating on carrier frequency C2 (318).

The radio node controller uses the relative reported signal strengths to determine whether a macro-to-pico handoff is to be performed (320). In the implementations in which the macro cell and the pico cell are homed to the same vendor, the radio node controller examines the reported pilot strengths of each pico cell 5 radio node to determine whether any one of the reported pilot strengths satisfies a condition (e.g., exceeds a configurable threshold for a configurable number of times). The pico cell associated with the reported strength that satisfies the condition is referred to as the target pico cell. Once a determination is made to trigger a macro-to-pico handoff, the radio node controller allocates airlink resources for the radio node of the 10 target pico cell, and sends a TrafficChannelAssignment message to the active access terminal over the control channel of each of the visible sectors associated with the target pico cell. Upon receipt of the TrafficChannelAssignment message, the active access terminal processes the TrafficChannelAssignment message to seamlessly transition from the carrier on which it operates to the carrier frequency C2 of the target 15 pico cell while remaining active.

In the implementations in which the macro and pico cells are homed to different vendors, the radio node controller determines when a macro-to-pico handoff is to be triggered as described above, then sends a Unicast Redirect message to the active access terminal to effect the handoff. The access terminal closes its current connection 20 with the network via the macro cell's radio node and opens a new connection with the network via the target pico cell's radio node. The user disruption associated with the "close connection- open connection" process typically averages about 1 second long.

The triggering mechanism can also be used to facilitate a transition from a pico cell to the macro cell. Generally, once an access terminal has transitioned to a local 25 pico cell, it will continue to access the network via the pico cell node while it remains parked, or within the coverage area of that pico cell. Once the access terminal becomes mobile, moving out of the coverage area of the pico cell, it will transition back to the macro cell.

An idle or active access terminal in the coverage area of a pico cell will 30 periodically report the pilot strengths of visible sectors to the network using a Route Update Message. In the idle case, the pico cell can include the macro cell's sector identification in its neighbor list, as described in U.S. Application Serial Number 11/303,773, (attorney docket 12144-028001) titled "Radio Frequency Dragging

Prevention.”. In those instances in which the radio node controller determines that the reported pilot strength of the serving pico cell radio node is below a configurable threshold (or the reported pilot strength of a macro cell radio node is exceeds a configurable threshold) for a configurable number of times, the radio node controller 5 sends a Unicast Redirect message to the access terminal to effect pico-to-macro handoff that involves a carrier frequency change from C2 (that of the pico cell radio node) to C1 (that of the macro cell radio node). In the active case, the radio node controller sends a TrafficChannelAssignment message to the access terminal to effect a seamless pico-to-macro handoff between cells homed to the same vendor. When the cells are homed to 10 different vendors, a Unicast Redirect message can be used, resulting in a brief disruption of service.

Although the techniques described above employ the 1xEV-DO air interface standard, the techniques are also applicable to other CDMA and non-CDMA air interface technologies involving handoffs or multi-carrier traffic allocation.

15 The techniques described above can be implemented in digital electronic circuitry, or in computer hardware, firmware, software, or in combinations of them. The techniques can be implemented as a computer program product, i.e., a computer program tangibly embodied in an information carrier, e.g., in a machine-readable storage device or in a propagated signal, for execution by, or to control the operation of, 20 data processing apparatus, e.g., a programmable processor, a computer, or multiple computers. A computer program can be written in any form of programming language, including compiled or interpreted languages, and it can be deployed in any form, including as a stand-alone program or as a module, component, subroutine, or other unit suitable for use in a computing environment. A computer program can be 25 deployed to be executed on one computer or on multiple computers at one site or distributed across multiple sites and interconnected by a communication network.

Method steps of the techniques described herein can be performed by one or more programmable processors executing a computer program to perform functions of the invention by operating on input data and generating output. Method steps can also 30 be performed by, and apparatus of the invention can be implemented as, special purpose logic circuitry, e.g., an FPGA (field programmable gate array) or an ASIC (application-specific integrated circuit). Modules can refer to portions of the computer program and/or the processor/special circuitry that implements that functionality.

Processors suitable for the execution of a computer program include, by way of example, both general and special purpose microprocessors, and any one or more processors of any kind of digital computer. Generally, a processor will receive instructions and data from a read-only memory or a random access memory or both.

- 5 The essential elements of a computer are a processor for executing instructions and one or more memory devices for storing instructions and data. Generally, a computer will also include, or be operatively coupled to receive data from or transfer data to, or both, one or more mass storage devices for storing data, e.g., magnetic, magneto-optical disks, or optical disks. Information carriers suitable for embodying computer program
- 10 instructions and data include all forms of non-volatile memory, including by way of example semiconductor memory devices, e.g., EPROM, EEPROM, and flash memory devices; magnetic disks, e.g., internal hard disks or removable disks; magneto-optical disks; and CD-ROM and DVD-ROM disks. The processor and the memory can be supplemented by, or incorporated in special purpose logic circuitry.

15 A number of embodiments of the invention have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the invention, and, accordingly, other embodiments are within the scope of the following claims.

What is claimed is:

20

CLAIMS

1. A method comprising:
enabling a radio access network to cause an access terminal in communication with the radio access network to send an update including information about a
5 location of the access terminal.
2. The method of claim 1, wherein the radio access network causes the access terminal to send the update by broadcasting trigger information.
3. The method of claim 2, wherein the trigger information comprises a trigger that is specific to a cell of the radio access network.
- 10 4. The method of claim 1, wherein the radio access network causes the access terminal to send the update by unicasting query information.
5. The method of claim 4, wherein the query information comprises a query that is specific to a cell of the radio access network.
- 15 6. The method of claim 4, wherein the query information comprises a query that is specific to a carrier frequency on which a radio node of the radio access network or a different radio access network operates.
7. The method of claim 1, wherein the information comprises information about one or more radio nodes each operating on a carrier frequency on which the access terminal operates.
- 20 8. The method of claim 1, wherein the information comprises information about one or more radio nodes, at least one of which operates on a carrier frequency other than a carrier frequency on which the access terminal operates.
9. The method of claim 1, wherein the information comprises a sector identifier and a pilot strength associated with a sector of a macro cell.
- 25 10. The method of claim 1, wherein the information comprises a sector identifier and a pilot strength associated with a sector of a pico cell.

11. The method of claim 1, further comprising:

using the information sent by the access terminal to determine whether a handoff between cells of the radio access network is to be performed.

12. A method comprising:

5 at an access terminal, performing a comparison of a recently-received cell-specific identifier with a previously-received cell-specific identifier; and taking action as a result of the comparison.

13. The method of claim 12, wherein each of the recently-received cell-specific identifier and the previously-received cell-specific identifier comprises a cell-10 specific route update trigger code.

14. The method of claim 12, wherein taking action comprises sending a message to a radio access network.

15. The method of claim 14, wherein the message comprises a pilot strength of at least one sector of the radio access network that is visible to the access terminal.

15 16. The method of claim 12, wherein taking action comprises replacing the previously-received cell-specific identifier with the recently-received cell-specific identifier.

17. An apparatus comprising:

a processor;
a memory including software that provides instructions to the processor to request an update from an access terminal, the update including information about the location of the access terminal.

18. The apparatus of claim 17, wherein the software provides instructions to the processor to request the update by broadcasting trigger information.

19. The apparatus of claim 17, wherein the software provides instructions to the processor to request the update by unicasting query information.

25 20. The apparatus of claim 17, wherein the information comprises a sector identifier and a pilot strength associated with a sector of a macro cell.

21. The apparatus of claim 17, wherein the information comprises a sector identifier and a pilot strength association with a sector of a pico cell.
22. An apparatus comprising:
 - means for requesting an update from an access terminal, the update including information about the location of the access terminal.
23. The apparatus of claim 22, wherein the means includes requesting the update by broadcasting trigger information.
24. The apparatus of claim 22, wherein the means includes requesting the update by unicasting query information.
- 10 25. The apparatus of claim 22, wherein the information comprises a sector identifier and a pilot strength associated with a sector of a macro cell.
26. The apparatus of claim 22, wherein the information comprises a sector identifier and a pilot strength association with a sector of a pico cell.
27. A system comprising:
 - 15 an access terminal;
 - a radio access network configured to cause the access terminal to send an update including information about the location of the access terminal.
28. The system of claim 27, wherein the radio access network causes the access terminal to send the update by broadcasting trigger information.
- 20 29. The system of claim 27, wherein the radio access network causes the access terminal to send the update by unicasting query information.
30. The system of claim 27, wherein the information comprises a sector identifier and a pilot strength associated with a sector of a macro cell.
- 25 31. The system of claim 27, wherein the information comprises a sector identifier and a pilot strength associated with a sector of a pico cell.
32. A method comprising:

when an access terminal is communicating with a first cell of a network and is within a service area of both the first cell of the network and a second cell of the network, determining when to initiate a handoff of the access terminal from the first cell to the second cell.

- 5 33. The method of claim 32, wherein the first cell comprises a macro cell and the second cell comprises a pico cell.
34. The method of claim 32, wherein the first cell comprises a pico cell and the second cell comprises a macro cell.
35. The method of claim 32, further comprising:
10 initiating the handoff.
36. The method of claim 35, wherein initiating comprises maintaining a communication channel of the access terminal.
37. The method of claim 36, wherein initiating further comprises sending a TrafficChannelAssignment message.
- 15 38. The method of claim 35, wherein initiating comprising closing a communication channel of the access terminal.
39. The method of claim 35, wherein initiating further comprises sending a Unicast Redirect message.
40. The method of claim 32, wherein determining comprises using information about
20 the location of the access terminal.
41. The method of claim 40, wherein the information comprises a sector identifier of the first cell.
42. The method of claim 40, wherein the information comprises a sector identifier of the second cell.
- 25 43. The method of claim 40, wherein the information comprises a pilot strength associated with a sector of the first cell.

44. The method of claim 40, wherein the information comprises a pilot strength associated with a sector of the second cell.
45. The method of claim 40, wherein the information comprises a sector identifier and a pilot strength associated with a sector of the first cell, and a sector identifier and a pilot strength associated with a sector of the second cell.
5
46. The method of claim 45, wherein determining further comprises comparing the pilot strength of the first cell with the pilot strength of the second cell.
47. The method of claim 32, wherein the first cell and the second cell both operate on a common carrier frequency.
- 10 48. The method of claim 32, wherein the first cell operates on a carrier frequency and the second cell operates on a different carrier frequency.

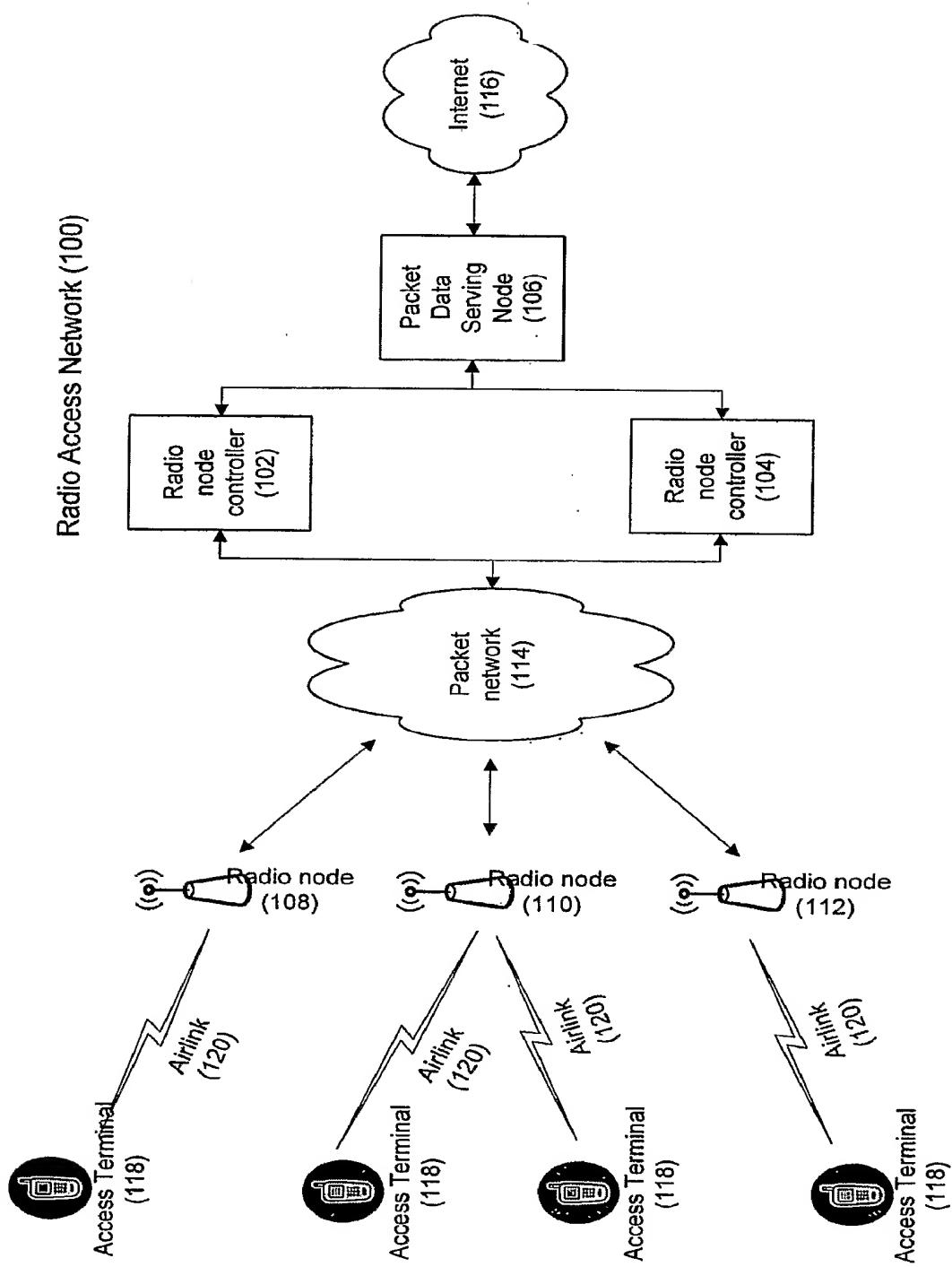
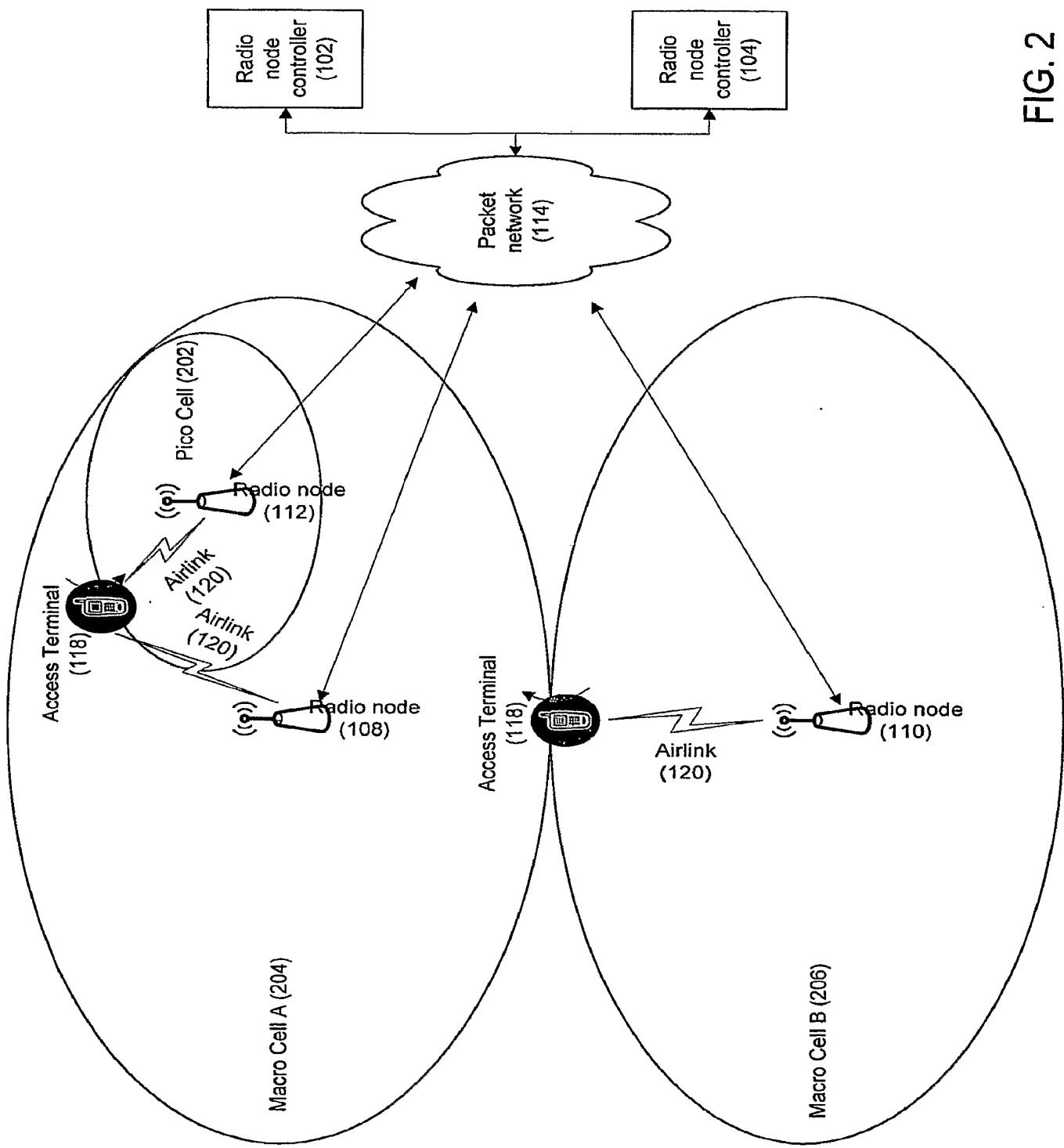


FIG. 1

FIG. 2



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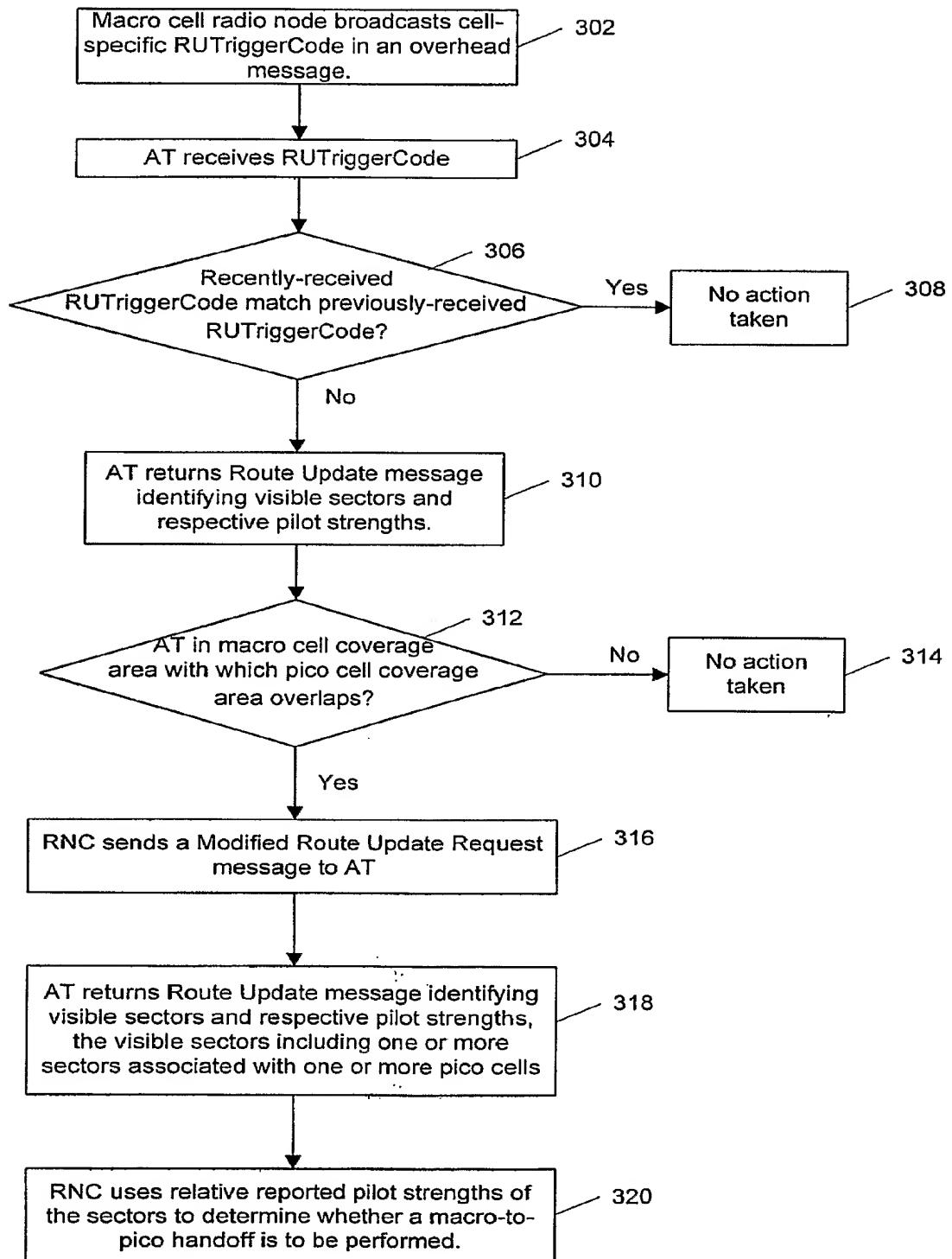


FIG. 3

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(30) Priority Data:
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(63) Related by continuation (CON) or continuation-in-part (CIP) to earlier application:

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Filed on 16 December 2005 (16.12.2005)

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(71) Applicant (for all designated States except US): **AIR-VANA, INC.** [US/US]; 19 Alpha Road, Chelmsford, MA 01824 (US).

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(72) Inventors; and

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(75) Inventors/Applicants (for US only): **GARG, Deepak** [IN/US]; 56 Stillwater Drive, Nashua, NH 03062 (US). **KNISELY, Douglas, Norman** [US/US]; 2313 Appleby Ct., Wheaton, IL 60187 (US). **PALNATI, Prasasth, R.** [US/US]; 27 Chicory Road, Westford, MA 01886 (US).

(54) Title: RADIO NETWORK COMMUNICATION

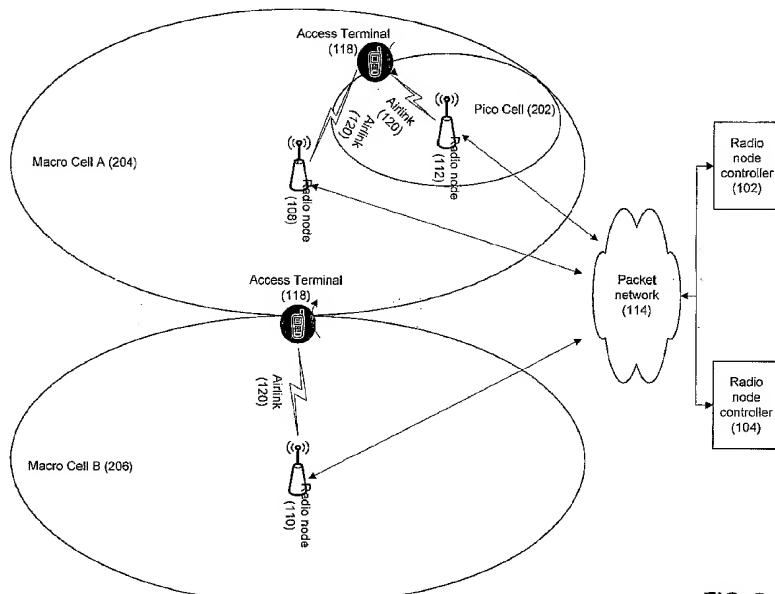


FIG. 2

(57) Abstract: Techniques for enabling a radio access network to cause an access terminal in communication with the radio access network to send an update including information about a location of the access terminal.

WO 2007/075446 A3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US06/47963

A. CLASSIFICATION OF SUBJECT MATTER
IPC: H04Q 7/24(2006.01)

USPC: 370/338

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/0102976 A1 (NEWBURY et al.) 01 August 2002 (01.08.2002), see entire document.	1-48
A,E	US 7,251,491 B2 (THA) 31 July 2007 (31.07.2007), see entire document.	1-48
A,E	US 7,162,247 B2 (BABA et al.) 09 January 2007 (09.01.2007), see entire document.	1-48
A,P	US 7,072,663 B2 (RAMOS et al.) 04 July 2006 (04.07.2006), see entire document.	1-48

<input type="checkbox"/>	Further documents are listed in the continuation of Box C.	<input type="checkbox"/>	See patent family annex.
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"P"	document published prior to the international filing date but later than the priority date claimed		

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